Summation of EPSPs and IPSPs

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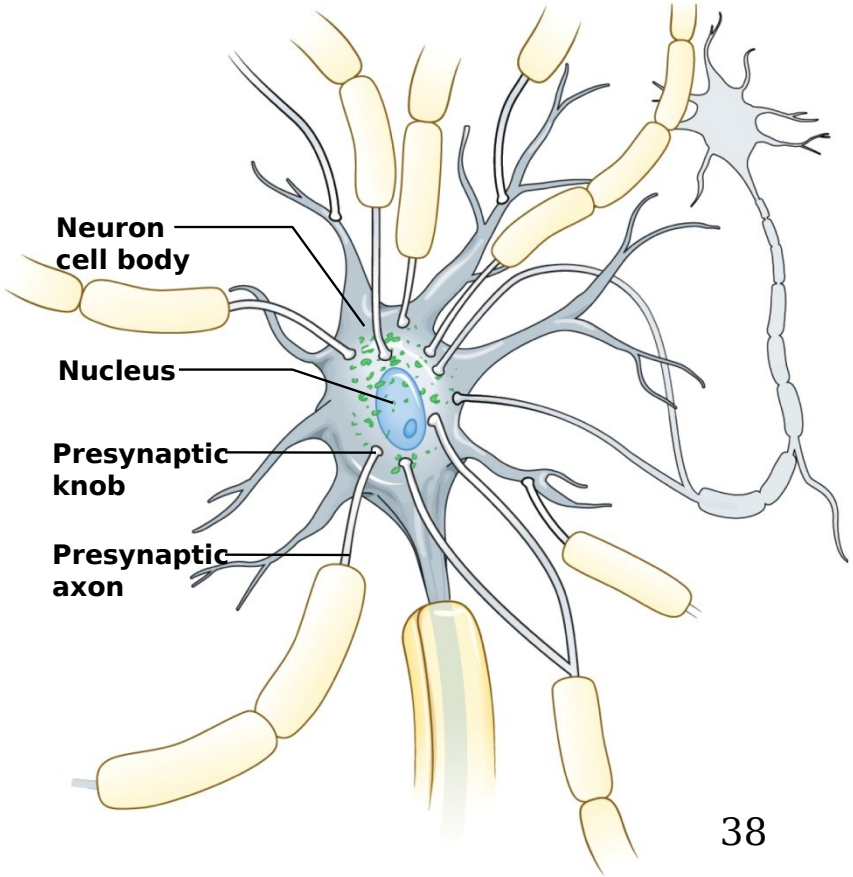
- EPSPs and IPSPs are added together in a process called summation
- More EPSPs lead to greater probability of an action potential



Neurotransmitters

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TABLE 10.4 | Some Neurotransmitters and Representative Actions

Neurotransmitter	Location	Major Actions
Acetylcholine	CNS	Controls skeletal muscle actions
	PNS	Stimulates skeletal muscle contraction at neuromuscular junctions. May excite or inhibit at autonomic nervous system synapses
Biogenic amines		
Norepinephrine	CNS	Creates a sense of well-being; low levels may lead to depression
	PNS	May excite or inhibit autonomic nervous system actions, depending on receptors
Dopamine	CNS	Creates a sense of well-being; deficiency in some brain areas associated with Parkinson disease
	PNS	Limited actions in autonomic nervous system; may excite or inhibit, depending on receptors
Serotonin	CNS	Primarily inhibitory; leads to sleepiness; action is blocked by LSD, enhanced by selective serotonin reuptake inhibitor antidepressant drugs
Histamine	CNS	Release in hypothalamus promotes alertness
Amino acids		
GABA	CNS	Generally inhibitory
Glutamate	CNS	Generally excitatory
Neuropeptides		
Enkephalins, endorphins	CNS	Generally inhibitory; reduce pain by inhibiting substance P release
Substance P	PNS	Excitatory; pain perception
Gases		
Nitric oxide	CNS	May play a role in memory
	PNS	Vasodilation

Neurotransmitters

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TABLE 10.7 | Events Leading to Neurotransmitter Release

1. Action potential passes along an axon and over the surface of its synaptic knob.
2. Synaptic knob membrane becomes more permeable to calcium ions, and they diffuse inward.
3. In the presence of calcium ions, synaptic vesicles fuse to synaptic knob membrane.
4. Synaptic vesicles release their neurotransmitter by exocytosis into the synaptic cleft.
5. Synaptic vesicles become part of the membrane.
6. The added membrane provides material for endocytotic vesicles.

Neuropeptides

- Neurons in the brain or spinal cord synthesize neuropeptides.

- These neuropeptides act as neurotransmitters.

- Examples include:
  - Enkephalins
  - *Beta* endorphin
  - Substance P

10.8: Impulse Processing

- Way the nervous system processes nerve impulses and acts upon them
  - Neuronal Pools
    - Interneurons
    - Work together to perform a common function
    - May excite or inhibit
  - Convergence
    - Various sensory receptors
    - Can allow for summation of impulses
  - Divergence
    - Branching axon
    - Stimulation of many neurons ultimately

Neuronal Pools

- Groups of interneurons that make synaptic connections with each other
- Interneurons work together to perform a common function
- Each pool receives input from other neurons
- Each pool generates output to other neurons

Convergence

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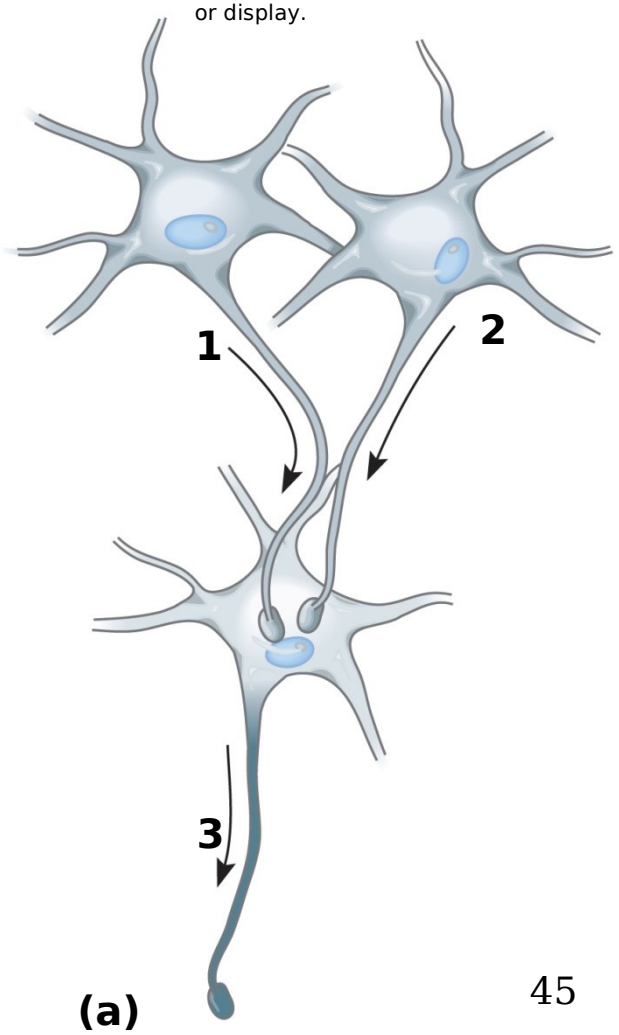
- Neuron receives input from several neurons
- Incoming impulses represent information from different types of sensory receptors
- Allows nervous system to collect, process, and respond to information
- Makes it possible for a neuron to sum impulses



Divergence

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- One neuron sends impulses to several neurons
- Can amplify an impulse
- Impulse from a single neuron in CNS may be amplified to activate enough motor units needed for muscle contraction